

## CLAIMS

1. A tire (1) for vehicles, comprising a tread (9) comprising a vulcanized polymeric base including:

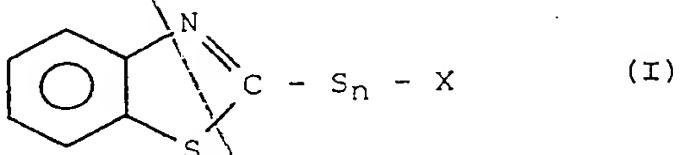
- 5       a) at least one reinforcing filler dispersed in said polymeric base,
- 10      b) an amount of extractable residue of at least one vulcanization accelerator containing at least one carbon atom bound to at least two sulfur atoms of from 0.5 to 1.8% by weight based on the total weight of the tread (9);
- 15      c) an amount of at least one activator, expressed as equivalents of zinc oxide, not higher than 2% by weight based on the total weight of the tread (9);
- 20      d) an amount of combined sulfur lower than 2.5% by weight based on the total weight of the tread (9).

25     2. The tire according to claim 1, wherein said vulcanized polymeric base is obtained starting from at least one polymer selected from the group comprising: natural rubber, polybutadiene, polychloroprene, polyisoprene, optionally halogenated isoprene-isobutene copolymers, butadiene-acrylonitrile copolymers, copolymers obtainable by polymerization of at least one conjugated diene with at least one vinyl aromatic hydrocarbon, optionally halogenated isobutylene/p-methyl styrene copolymers, styrene-butadiene-isoprene terpolymers, obtained either in solution or in emulsion, ethylene-propylene-diene terpolymers, and mixtures thereof.

30     3. The tire according to claim 1, wherein said at least one vulcanization accelerator is selected from among accelerators including at least one 2-benzothiazole or sulphenamide group.

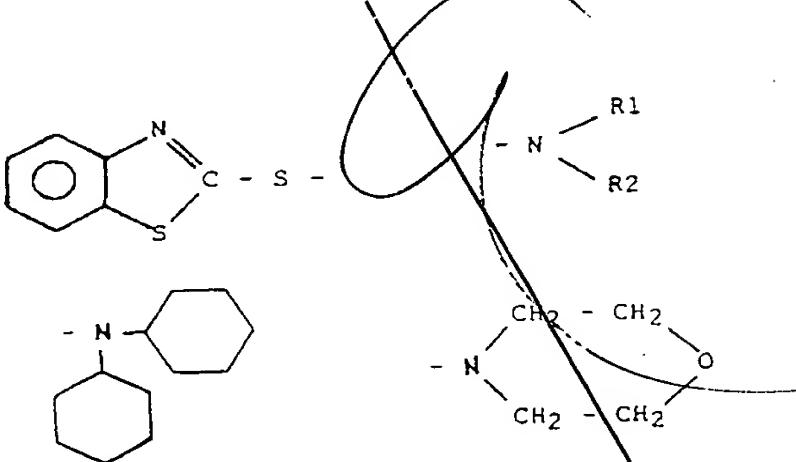
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4. The tire according to claim 3, wherein said at least one vulcanization accelerator has the following structural formula:

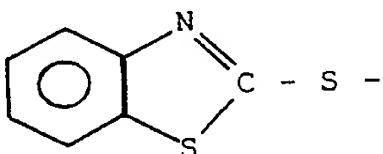


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wherein n is an integer of from 1 to 5 and X is H or a group selected from:



10 wherein R1 and R2 are independently H, an alkyl group, a saturated ring optionally comprising C, S or O, a cycloalkyl group having 5 or 6 carbon groups or a group



15 5. The tire according to anyone of claims 3 or 4, wherein said at least one vulcanization accelerator is selected from the group comprising: 2-mercaptobenzothiazole (MBT),

- dibenzothiazyl disulphide (MBTS), N-cyclohexyl-2-  
benzothiazyl-sulphenamide (CBS), N-tert.butyl-2-  
benzothiazyl sulphenamide (TBBS), 2-morpholinthia-2-  
benzothiazole (MBS), N-dicyclohexyl-2-benzothiazyl  
5 sulphenamide (DCBS), benzothiazyl-2-diisopropyl  
sulphenamide (DIBS), benzothiazyl-2-tert.amyl sulphenamide  
(AMZ), morpholine-thiocarbonyl sulphenmorpholine (OTOS), N-  
tert.butyl-2-benzothiazol sulphenamide (TBSI), and mixtures  
thereof.
- 10 6. The tire according to claim 3, wherein the weight ratio  
between the extractable residue of the vulcanization  
accelerator and the amount of said at least one activator,  
expressed in terms of zinc oxide equivalents, is not higher  
than 10.
- 15 7. The tire according to claim 1, wherein the weight ratio  
between the combined sulfur and the extractable residue of  
the vulcanization accelerator is of from 1.2 to 2.8.
- 20 8. The tire according to claim 1, wherein said at least one  
activator is selected from the group comprising: the  
oxygenated compounds of a metal selected from Zn, Bi, Pb,  
the salts formed between said metal and a fatty acid,  
either saturated or unsaturated, having from 8 to 18 carbon  
atoms, and mixtures thereof.
- 25 9. The tire according to claim 1, wherein said at least one  
reinforcing filler is selected from carbon black and  
silica.
10. The tire according to claim 9, characterized in that it  
comprises from 0 to 100 phr of carbon black and from 0 to  
100 phr of silica.
- 30 11. A tread (9) for vehicle tires, comprising a vulcanized  
polymeric base including:  
a) at least one reinforcing filler dispersed in said

~~polymeric base,~~

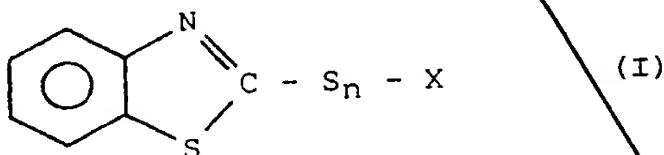
b) an amount of extractable residue of at least one vulcanization accelerator containing at least one carbon atom bound to at least two sulfur atoms of from 0.5 to 1.8% by weight based on the total weight of the tread (9);

c) an amount of at least one activator, expressed as equivalents of zinc oxide, not higher than 2% by weight based on the total weight of the tread (9);

d) an amount of combined sulfur lower than 2.5% by weight based on the total weight of the tread (9).

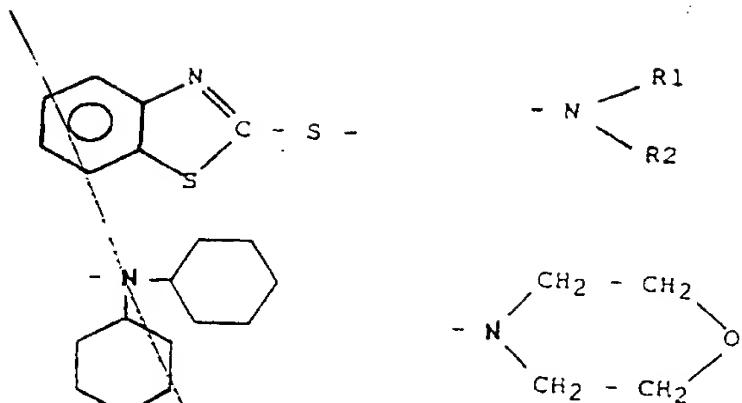
12. The tread according to claim 11, wherein said at least one vulcanization accelerator is selected from accelerators including at least one benzothiazole or sulphenamide group.

13. The tread according to claim 12, wherein said at least one vulcanization accelerator has the following structural formula:



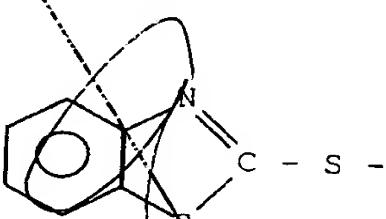
20 wherein n is an integer of from 1 to 5 and X is H or a group selected from:

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wherein R1 and R2 are independently H, an alkyl group, a saturated ring optionally comprising C, S or O, a cycloalkyl group having 5 or 6 carbon group or a group

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14. The tread according to claim 11, wherein the weight ratio between the extractable residue of the vulcanization accelerator and the amount of said at least one activator, expressed in terms of zinc oxide equivalents, is not higher than 10.

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15. The tread according to claim 11, wherein the weight ratio between the combined sulfur and the extractable residue of the vulcanization accelerator is of from 1.2 to 2.8.

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16. The tread according to claim 11, wherein said at least one activator is selected from the group comprising: the oxygenated compounds of a metal selected from Zn, Bi, Pb, the salts formed between said metal and a fatty acid, either saturated or unsaturated, having from 8 to 18 carbon atoms, and mixtures thereof.

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17. The tread according to claim 11, wherein said at least one reinforcing filler is selected between carbon black and silica.

18. A vulcanizable rubber composition for the manufacture  
5 of a tread for vehicle tires comprising:

a) a cross-linkable unsaturated chain polymeric base;

b) a vulcanizing system comprising:

b1) an amount of sulfur of from 0.5 to 2 phr;

10 b2) an amount of from 1.5 to 7 phr of at least one vulcanization accelerator containing at least one carbon atom bound to at least two sulfur atoms;

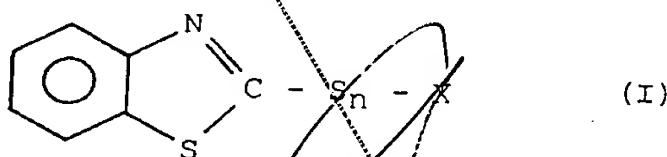
b3) an amount not higher than 2 phr, expressed in terms of zinc oxide equivalents, of at least one activator.

15 19. The vulcanizable rubber composition according to claim 18, wherein said cross-linkable unsaturated chain polymeric base comprises at least one polymer selected from the group comprising: natural rubber, polybutadiene, polychloroprene, polyisoprene, optionally halogenated isoprene-isobutene copolymers, butadiene-acrylonitrile copolymers, copolymers obtainable by polymerization of at least one conjugated diene with at least one vinyl aromatic hydrocarbon, optionally halogenated isobutylene/p-methyl styrene copolymers, styrene-butadiene-isoprene terpolymers, 20 obtained either in solution or in emulsion, ethylene-propylene-diene terpolymers, and mixtures thereof.

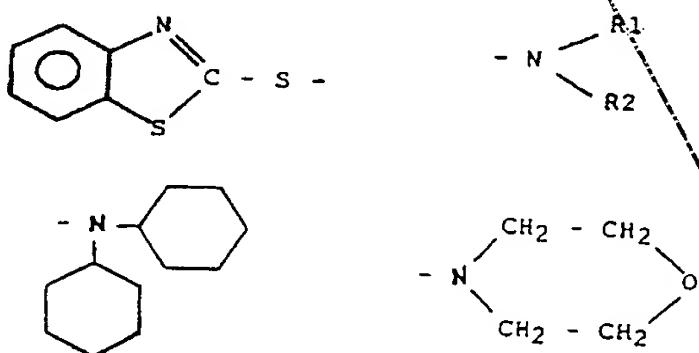
25 20. The vulcanizable rubber composition according to claim 18, wherein the sulfur of the vulcanizing system is provided by elementary sulfur or by at least one sulfur donor selected from the group comprising: dithiobismorpholine, dithiobiscaprolactame,

dipentamethylene thiuram tetrasulphide,  
 dialkyldithiophosphate polysulphide, bis-  
 triethoxysilylpropyl polysulphide, alkylphenoldisulphides,  
 and mixtures thereof.

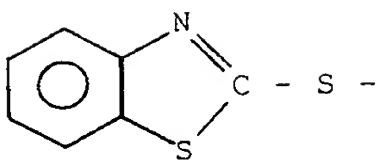
- 5 21. The vulcanizable rubber composition according to claim  
 18, wherein said at least one vulcanization accelerator is  
 selected from among accelerators including at least one  
 benzothiazole or sulphenamide group.
- 10 22. The vulcanizable rubber composition according to claim  
 21, wherein said at least one vulcanization accelerator has  
 the following structural formula:



- 15 wherein n is an integer of from 1 to 5 and X is H or a  
 group selected from:



- 20 wherein R1 and R2 are independently H, an alkyl group, a  
 saturated ring optionally comprising C, S or O, a  
 cycloalkyl group having 5 or 6 carbon groups or a group



23. The vulcanizable rubber composition according to anyone of claims 18 or 22, wherein said at least one vulcanization accelerator is selected from the group comprising: 2-mercaptopbenzothiazole (MBT), dibenzothiazyl disulphide (MBTS), N-cyclohexyl-2-benzothiazyl-sulphenamide (CBS), N-tert.butyl-2-benzothiazyl sulphenamide (TBBS), 2-morpholinethia-2-benzothiazole (MBS), N-dicyclohexyl-2-benzothiazyl sulphenamide (DCBS), benzothiazyl-2-diisopropyl sulphenamide (DIBS), benzothiazyl-2-tert.amyl sulphenamide (AMZ), morpholine-thiocarbonyl sulphenmorpholine (OTOS), N-tert.butyl-2-benzothiazol sulphenamide (TBSI), and mixtures thereof.
- 15 24. The vulcanizable rubber composition according to claim 18, wherein the weight ratio between the sulfur of the vulcanizing system and the vulcanization accelerator is of from 0.16 to 0.48.
- 20 25. The vulcanizable rubber composition according to claim 21, wherein the weight ratio between the amount of 2-benzothiazole groups coming from the vulcanization accelerator and the amount of said at least one activator, expressed in terms of zinc oxide equivalents, is not higher than 10.
- 25 26. The vulcanizable rubber composition according to claim 18, characterized in that it further comprises at least one secondary vulcanization accelerator, selected from diphenylguanidines, dithiocarbamates, thiurams, and mixtures thereof.

27. The vulcanizable rubber composition according to claim 26, wherein said at least one secondary vulcanization accelerator is selected from the group comprising: diphenyl guanidine (DPG), zinc dimethyl dithiocarbamate (ZDMC), zinc diethyl dithiocarbamate (ZDEC), zinc dibutyl dithiocarbamate (ZDBC), zinc ethyl-phenyl dithiocarbamate (ZEPC), zinc dibenzyl dithiocarbamate (ZBEC), tetramethylthiuram disulphide (TMTD), tetramethylthiuram monosulphide (TMMT), dimethyl diphenyl thiuram disulphide, and mixtures thereof.
28. The vulcanizable rubber composition according to claim 18, wherein said at least one activator is selected from the group comprising: the oxygenated compounds of a metal selected from Zn, Bi, Pb, the salts formed between said metal and a fatty acid, either saturated or unsaturated, having from 8 to 18 carbon atoms, and mixtures thereof.
29. The vulcanizable rubber composition according to claim 18, further comprising at least one reinforcing filler selected from carbon black and silica.
30. The vulcanizable rubber composition according to claim 29, comprising from 0 to 100 phr of carbon black and from 0 to 100 phr of silica.
31. A vulcanizing system for vehicle tires, including:
- an amount of sulfur of from 0.5 to 2 phr;
  - an amount of from 1.5 to 7 phr of at least one vulcanization accelerator containing at least one carbon atom bound to at least two sulfur atoms;
  - an amount not higher than 2 phr, expressed in terms of zinc oxide equivalents, of at least one activator.
32. A process for manufacturing a tire for vehicle wheels, comprising the steps of preparing around the circumference

of a belt structure (12) a tread (9) according to anyone of claims 11-17, and of linking by vulcanization said tread (9) to said belt structure (12).

33. A process for covering a worn tire for vehicle wheels,  
5 comprising the steps of preparing around the circumference  
of a belt structure (12) a tread (9) according to anyone of  
claims 11-17, and of irreversibly linking said tread (9) to  
said belt structure (12).

34. A method for increasing the wear resistance of a tire  
10 (1), said tire (1) being provided with at least one carcass  
ply (2) on which a belt structure (12) is circumferentially  
applied, and with a tread (9) circumferentially applied  
around said belt structure (12) and externally provided  
15 with a rolling surface (9a) suitable to get in touch with  
the ground,

characterized in that the tire (1) is provided with a tread  
(9) according to anyone of claims 11-17.

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